PATENT ABSTRACTS OF JAPAN

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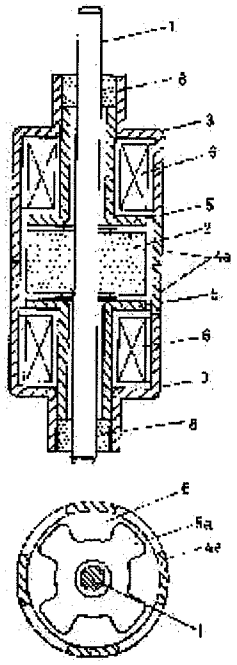
(72)Inventor : **ANDO AKIO**

(54) **STEPPING MOTOR**



(57)Abstract:

PURPOSE: To provide a small light stepping motor for a camera lens with a conventional small magnet that can be magnetized minutely with multi-polarity.

CONSTITUTION: A comb-shaped pole tooth 4a at a frame end or a pole tooth 4a made of an outer-yoke rib around the frame is provided around an outer face magnetized with multi-polarity in a magnet 2. At the same time, a pole tooth 5b of a petal-shaped inner yoke 5 is provided opposite to a magnetic flux generating side face of the magnet 2. A coil 6 is put on the lateral faces of magnet 2 in the axial direction. In these steps, the outer diameter of the outer-yoke pole tooth 4a is made equal to that of the motor, so the outer diameter of the motor can be reduced even when a conventional small motor is used. Moreover, a sectional area of the coil is sufficient even with a small inner diameter of the coil, and a small light stepping motor with high performance can be obtained.

CLAIMS

[Claim(s)]

[Claim 1]A stepping motor, wherein a pole gear of an outer yoke counters a peripheral face of a magnet and a pole gear of an inner yoke has countered a radial direction on the magnet side in a claw pole shaped stepping motor using a rotor magnet by which multi-electrode magnetization was carried out.

[Claim 2]The stepping motor according to claim 1, wherein a pole gear of said outer yoke is constituted by notch of the shape of a ctenidium of a cup shape frame end part.

[Claim 3]The stepping motor according to claim 1, wherein a pole gear of said outer yoke is constituted by rib of a cup shape frame side.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to the small stepping motor used for a video camera, a still camera, etc.

[0002]

[Description of the Prior Art]In recent years, a stepping motor is used also for noncommercial new uses, such as a drive of the lens for cameras, and the miniaturization and the weight saving are demanded still further in connection with this.

[0003]The conventional stepping motor is explained below. Drawing 4 shows the section of the conventional stepping motor. In drawing 4, the magnet 2 magnetized by the radial direction at even pitch is fixed to the shaft 1, and the rotor is constituted. The outer yoke 4 and the inner yoke 5 are stored in the frame 3 of cup shape [sets / 2] on both sides of the coil 6 by the position which meets the periphery of the magnet 2, respectively, and the stator part constitutes in it. The shaft 1 can rotate now free to the frame 3 and the bracket 7 by the bearing 8 by which press fit immobilization is carried out.

[0004]
[Problem(s) to be Solved by the Invention]However, in the above-mentioned conventional structure, since the coil 6 was installed in the outside of the outer yoke 4 and the inner yoke 5 which counter the periphery of the magnet 2, in order to be the miniaturization of a motor, the outside diameter of coil and the magnet outer diameter needed to be made small.
[0005]When an outside diameter of coil was made small, reduction of the coil cross-section area was caused, and since sufficient magnetomotive force was no longer acquired, degradation had arisen.
[0006]When a magnet outer diameter was furthermore made small, since a magnetization pitch became minute when performing multi-electrode magnetization to a magnet periphery, even if sufficient magnetization power was not obtained by the magnetic saturation of the magnetization yoke but it used the highly efficient magnet by it, there was a problem that the fall of torque arose.
[0007]For example, when it was going to obtain the stepping motor of 18 step angles, in order to magnetize ten poles to a magnet, the magnet outer diameter of 4 mm was a limit, and the motor outer diameter of 8 mm was a limit of the miniaturization with structure conventionally which installed the yoke and the coil in the outside.
[0008]This invention solves the above-mentioned conventional problem, and provides small size and a lightweight and highly efficient stepping motor.
[0009]
[Means for Solving the Problem]To achieve the above objects, a stepping motor of this invention has the structure where a pole gear of an outer yoke meets a peripheral face of a magnet, and a pole gear of an inner yoke meets the magnet side.
[0010]
[Function]Since according to the above-mentioned structure it becomes possible to arrange a coil on the side of a magnet and an inside diameter of coil can be made small, even if a motor outer diameter becomes small and an outside diameter of coil becomes still smaller, sufficient coil cross-section area is securable.
[0011]Since the outer diameter of the outer yoke which met the peripheral face of the magnet itself becomes the same as that of a motor outer diameter, the miniaturization of a motor outer diameter

can be performed without diverting the magnet of the conventionally same easy outer diameter as elegance of magnetization, and changing travel.

[0012]

[Example]Hereafter, it explains, referring to drawing 1 and drawing 2 for one example of this invention.

[0013]In drawing 1, on both sides of the coil 6, insertion combination of the inner yoke 5 is carried out, only a frame, a coil, and the inner yoke and step angle of a lot already shift to an inside, and the frame 3 is combined with it back to back. The shaft 1 is fixed to the rotor magnet 2, and same number magnetization of a n pole and the south pole is carried out in the pitch at equal intervals at the periphery, respectively. By the bearing 8 attached to the frame 3, the shaft 1 can rotate now free.

[0014]As shown in drawing 2, it lacks at the end of the frame 3 at the interval same in the shape of a ctenidium as the magnetization pitch of the rotor magnet 2, and portion and pole gear A4a is provided in it by turns. In the inner yoke 5, it lacks at the same interval as the magnetization pitch of the rotor magnet 2, and pole gear B5a of a part and the shape of a petal is provided by turns. Pole gear A4a of the end of the frame 3 is located pole gear B5a of the inner yoke 5, and by turns, and it interferes in it.

[0015]Here, since pole gear A4a of the end of the frame 3 faces each other on both sides of the air gap to a part for the magnetic flux generating part of the peripheral face of the magnet 2, direction of the magnetic flux generated with the coil 6 performs suction repulsion between the peripheral faces of the magnet 2 like the pole gear of the outer yoke 4 of a conventional example.

[0016]Since magnetic flux is generated also in the side of the magnet 2 on the other hand like [peripheral face] a peripheral face to a 0.5-1-mm depth portion and pole gear B5a of the inner yoke 5 faces each other on both sides of the air gap to this side, Direction of the magnetic flux generated with the coil 6 performs suction repulsion between the sides of the magnet 2 like the pole gear of the inner yoke 5 of a conventional example.

[0017]Thus, it can be made to operate as a stepping motor by the completely same coil excitation method as a conventional example.

[0018]Since the yoke outer diameter which separated the air gap to

the magnet periphery turns into a motor outer diameter as it is, even if it uses the magnet of the same outer diameter to structure conventionally, according to this example, a miniaturization becomes possible more with the same travel.

[0019]If it is considered as the structure which provided the rib in the periphery of the side of the frame 3 like drawing 3, invasion of the foreign matter from the portion of the shape of a ctenidium of frame 3 end can be prevented, or shortage of the pole gear intensity of a ctenidium-like portion can be compensated.

[0020]

[Effect of the Invention]Since it is constituted according to this invention so that the pole gear of an outer yoke may counter the peripheral face of a magnet and the pole gear of an inner yoke may counter the magnet side so that clearly from the above example, Since it becomes still more nearly securable [the miniaturization of a motor outer diameter, and a coil cross-section area] even if it uses the magnet of the same outer diameter as the former, small size and the lightweight and highly efficient outstanding stepping motor can be provided.

TECHNICAL FIELD

[Industrial Application]This invention relates to the small stepping motor used for a video camera, a still camera, etc.

PRIOR ART

[Description of the Prior Art]In recent years, a stepping motor is used also for noncommercial new uses, such as a drive of the lens for cameras, and the miniaturization and the weight saving are demanded still further in connection with this.

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MEANS

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OPERATION

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]The axial sectional view of the stepping motor in one example of this invention

[Drawing 2]The stepping motor sectional view in one example of this invention

[Drawing 3]The stepping motor sectional view in other examples of this invention

[Drawing 4]The axial sectional view of the conventional stepping motor

[Description of Notations]

1 Shaft

2 Magnet

3 Frame

4 Outer yoke

4a Pole gear A

5 Inner yoke

5a Pole gear B

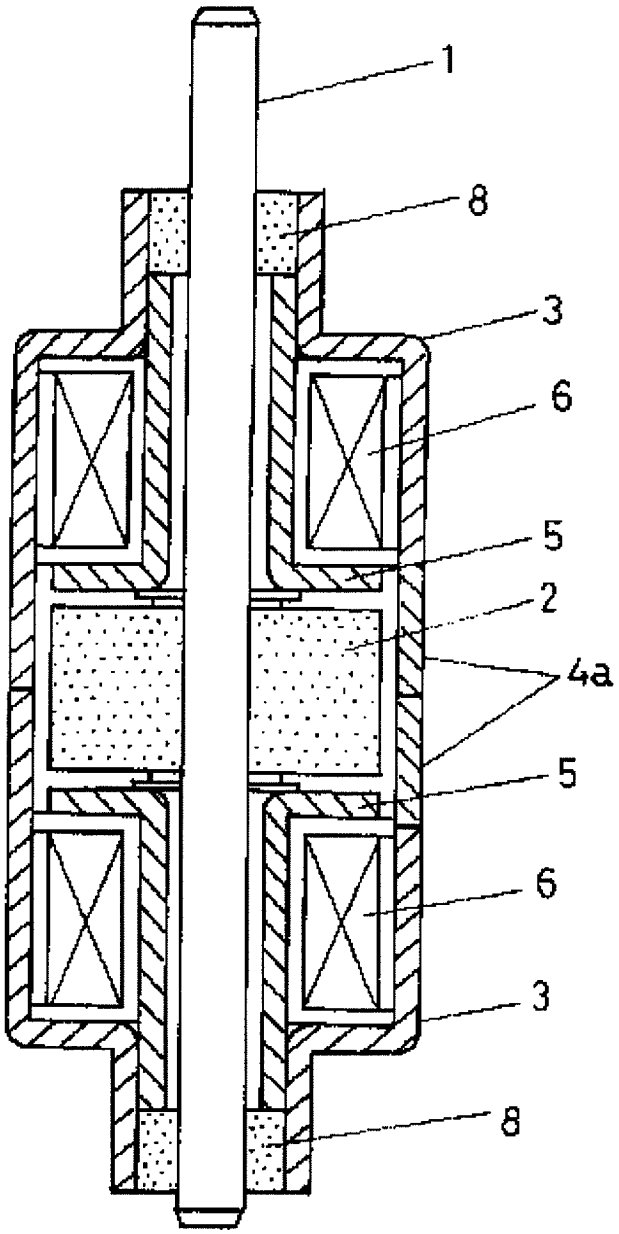
6 Coil

7 Bracket

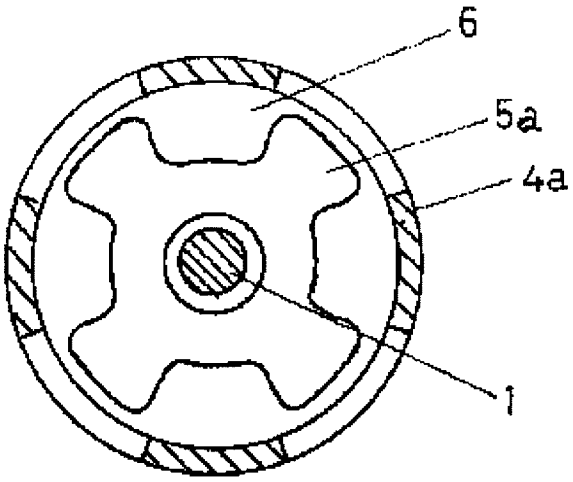
8 Bearing

DRAWINGS

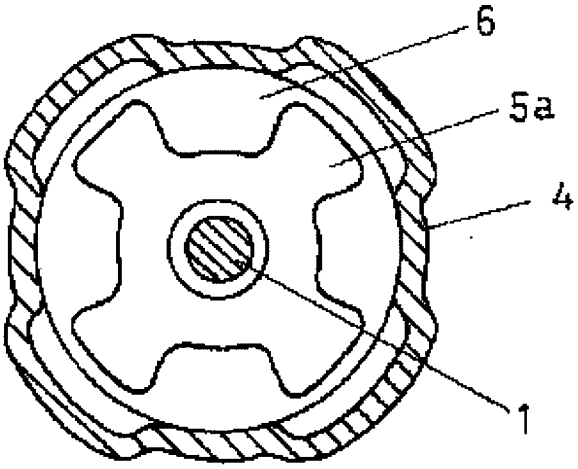
[Drawing 1]



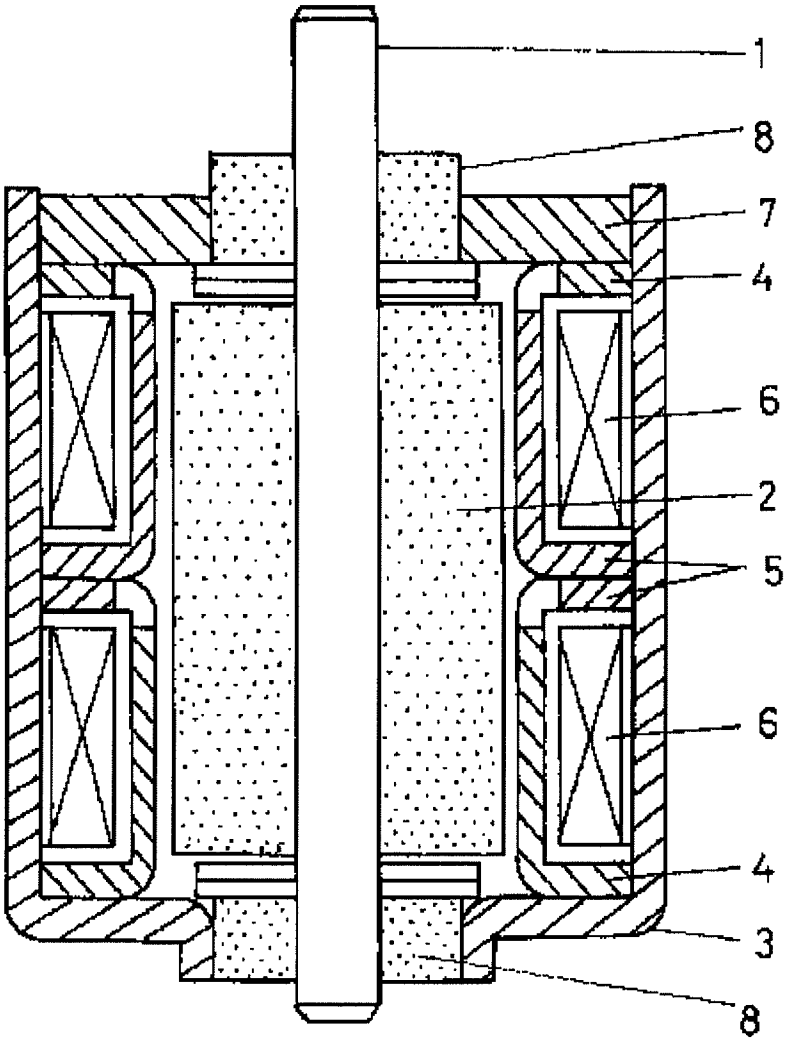
[Drawing 2]



[Drawing 3]



[Drawing 4]



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Ｈ０２Ｋ　37/14	５３５　Ｃ	9180－5H		
37/12	５２３	9180－5H		

審査請求　未請求　請求項の数３　ＯＬ　（全 ３ 頁）

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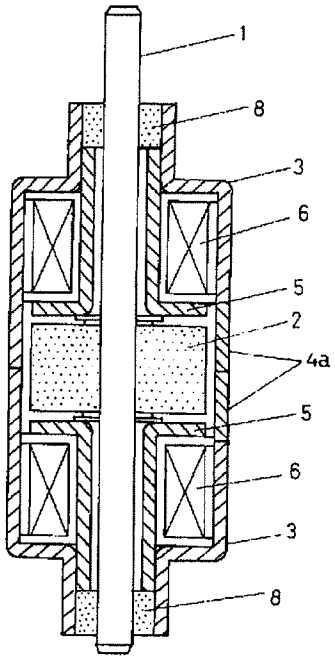
(54)【発明の名称】　ステッピングモータ

(57)【要約】

【目的】　従来より使用されている微小多極着磁の可能な小型マグネットを使用して、さらに小型，軽量のカメラレンズ用のステッピングモータを提供する。

【構成】　フレーム端に設けた櫛歯状、またはフレーム外周のリブによって形成された外ヨーク４の極歯Ａをマグネット２の多極着磁された外周面に、花びら状の内ヨーク５の極歯Ｂをマグネット２の側面の磁束発生部に対面させる構造としコイル６をマグネット２の軸方向側面に配置する。外ヨークの極歯の外径がモータ外径と同一となり、従来の小型マグネットを使用してもモータ外径を小さくできると同時にコイル内径を小さくして十分なコイル断面積が確保できるため、小型，軽量で高性能のステッピングモータが得られる。



【特許請求の範囲】
【請求項１】ラジアル方向に多極着磁されたロータマグネットを用いたクローポール型ステッピングモータにおいて、外ヨークの極歯がマグネットの外周面に、内ヨークの極歯がマグネット側面に対向していることを特徴とするステッピングモータ。
【請求項２】前記外ヨークの極歯がカップ状のフレーム端部の櫛歯状の切欠きによって構成されていることを特徴とする請求項１記載のステッピングモータ。
【請求項３】前記外ヨークの極歯がカップ状フレーム側面のリブによって構成されていることを特徴とする請求項１記載のステッピングモータ。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明はビデオカメラやスチルカメラ等に用いられる小型ステッピングモータに関するものである。
【０００２】
【従来の技術】近年、ステッピングモータはカメラ用レンズの駆動等の民生用の新しい用途にも使用され、これに伴い小型化，軽量化がなおいっそう要求されている。
【０００３】以下に従来のステッピングモータについて説明する。図４は従来のステッピングモータの断面を示すものである。図４において、シャフト１にラジアル方向に等ピッチに着磁されたマグネット２が固定され、ロータを構成している。そのマグネット２の外周に対面する位置に、外ヨーク４と内ヨーク５がコイル６を挟んでそれぞれ２組がカップ状のフレーム３に収められ、ステータ部が構成している。シャフト１は、フレーム３およびブラケット７に圧入固定されている軸受８によって自在に回転できるようになっている。
【０００４】
【発明が解決しようとする課題】しかし上記の従来の構造では、マグネット２の外周に対向する外ヨーク４および内ヨーク５の外側にコイル６が設置されているため、モータの小型化のためにはコイル外径とマグネット外径を小さくする必要があった。
【０００５】コイル外径を小さくした場合、コイル断面積の減少をきたし、十分な起磁力が得られなくなるため性能低下が生じていた。
【０００６】さらにマグネット外径を小さくした場合、マグネット外周へ多極着磁を行う際に着磁ピッチが微小となるため着磁ヨークの磁気飽和によって十分な着磁力が得られず、高性能のマグネットを使用してもトルクの低下が生じるという問題点があった。
【０００７】たとえば、ステップ角１８度のステッピングモータを得ようとした場合、マグネットに１０極の着磁を行うためマグネット外径４㎜が限界であり、その外側にヨーク，コイルを設置した従来構造ではモータ外径８㎜が小型化の限界であった。
【０００８】本発明は上記従来の問題を解決し、小型，軽量で高性能のステッピングモータを提供するものである。
【０００９】
【課題を解決するための手段】上記目的を達成するために、本発明のステッピングモータは外ヨークの極歯がマグネットの外周面に、内ヨークの極歯がマグネット側面に対面する構造を有している。
【００１０】
【作用】上記構造によれば、コイルをマグネットの側面に配置することが可能となり、コイル内径を小さくすることができるため、モータ外径が小さくなりコイル外径がさらに小さくなっても十分なコイル断面積が確保できる。
【００１１】また、マグネットの外周面に対面した外ヨークの外径そのものがモータ外径と同一となるため、着磁の容易な従来品と同じ外径のマグネットを流用してステップ角度を変更することなくモータ外径の小型化ができる。
【００１２】
【実施例】以下、本発明の一実施例について図１および図２を参照しながら説明する。
【００１３】図１において、フレーム３は内部にコイル６を挟んで内ヨーク５が挿入結合されており、もう一組のフレーム，コイル，内ヨークとステップ角だけずれて背中合わせに結合されている。ロータマグネット２にはシャフト１が固定され、外周には等間隔のピッチでＮ極，Ｓ極がそれぞれ同数着磁されている。シャフト１はフレーム３に取りつけられた軸受８によって、自在に回転できるようになっている。
【００１４】フレーム３の端部には、図２に示すように、櫛歯状にロータマグネット２の着磁ピッチと同じ間隔で欠き取り部分と極歯Ａ４ａが交互に設けられている。また、内ヨーク５にはロータマグネット２の着磁ピッチと同じ間隔で欠き取り部と花びら状の極歯Ｂ５ａが交互に設けられている。さらに、フレーム３の端部の極歯Ａ４ａは内ヨーク５の極歯Ｂ５ａと交互に位置して干渉しないようになっている。
【００１５】ここで、フレーム３の端部の極歯Ａ４ａはマグネット２の外周面の磁束発生部分に対してエアギャップを挟んで向かい合っているので、コイル６で発生される磁束の向きによって従来例の外ヨーク４の極歯と同様にマグネット２の外周面との間で吸引反発作用を行う。
【００１６】一方、マグネット２の側面においても外周面より０．５～１㎜の深さ部分まで外周面と同様に磁束を発生しており、内ヨーク５の極歯Ｂ５ａはこの側面に対してエアギャップを挟んで向かい合っているので、コイル６で発生される磁束の向きによって従来例の内ヨーク５の極歯と同様にマグネット２の側面の間で吸引反発

作用を行う。

【００１７】このように、従来例とまったく同様のコイル励磁方法でステッピングモータとして動作させることができる。

【００１８】マグネット外周に対しエアギャップを隔てたヨーク外径がそのままモータ外径となるため、従来構造に対して同じ外径のマグネットを使用しても本実施例によれば同じステップ角度のまま、より小型化が可能になる。

【００１９】図３のようにフレーム３の側面の外周にリブを設けた構造とすれば、フレーム３端部の櫛歯状の部分からの異物の侵入を防止したり、櫛歯状の部分の極歯強度の不足を補うことができる。

【００２０】

【発明の効果】以上の実施例から明らかなように、本発明によれば外ヨークの極歯がマグネットの外周面に、内ヨークの極歯がマグネット側面に対向するように構成されているため、従来と同じ外径のマグネットを使用してもさらにモータ外径の小型化とコイル断面積の確保が可能となるので、小型，軽量で高性能な優れたステッピングモータを提供することができる。

【図面の簡単な説明】

【図１】本発明の一実施例におけるステッピングモータの軸方向断面図

【図２】本発明の一実施例におけるステッピングモータ断面図

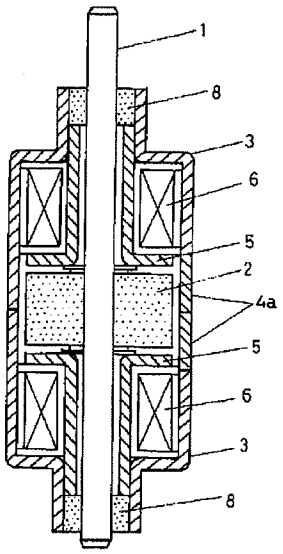
【図３】本発明の他の実施例におけるステッピングモータ断面図

【図４】従来のステッピングモータの軸方向断面図

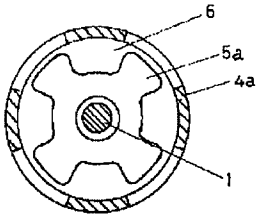
【符号の説明】

１　シャフト
２　マグネット
３　フレーム
４　外ヨーク
４ａ　極歯Ａ
５　内ヨーク
５ａ　極歯Ｂ
６　コイル
７　ブラケット
８　軸受

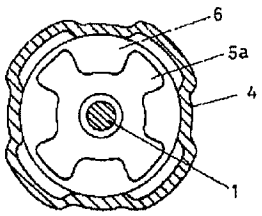
【図１】



【図２】



【図３】



【図４】